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# NONCONTINGENT ESCAPE AS TREATMENT FOR SELF-INJURIOUS BEHAVIOR MAINTAINED BY NEGATIVE REINFORCEMENT

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We extended research on the role of noncontingent positive reinforcement following a functional analysis of attention-maintained self-injurious behavior to self-injury maintained by negative reinforcement in 2 young males with developmental disabilities. During a pretreatment functional analysis, each participant's self-injury was shown to be differentially sensitive to escape from instructional activities as negative reinforcement. During noncontingent escape, escape from learning activities was provided on a fixed-time schedule that was not influenced by the participant's behavior. One participant was also exposed to differential negative reinforcement of other behavior. During this condition, escape from instructional activities was provided contingent on the omission of self-injury for prespecified intervals. Results showed that the provision of escape, even when noncontingent, resulted in significant reductions in self-injury. These results are particularly interesting in light of the experimental history of noncontingent reinforcement as a control rather than as a therapeutic procedure. Noncontingent escape is discussed as a form of extinction that may be less likely than other forms of extinction to produce severe side effects.

DESCRIPTORS: self-injurious behavior, noncontingent escape, differential negative reinforcement, functional analysis

Noncontingent reinforcement is an emerging intervention technology (Hagopian, Fisher, & Legacy, 1994; Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993). Despite a long history as a control procedure, noncontingent reinforcement is a viable intervention if the reinforcers being provided are from the same class of reinforcers maintaining undesirable behavior. Noncontingent reinforcement can be viewed as an extinction procedure, because the contingency between aberrant behavior and the reinforcing consequence is eliminated (Hagopian et al., 1994). Further, noncontingent reinforcement may result in fewer extinction-induced effects in comparison to traditional extinction procedures, because the client has free and frequent access to reinforcers.

Vollmer et al. (1993) discussed noncontingent positive reinforcement (NCR) as a possible alternative to differential reinforcement. Typically, differential reinforcement is the most directly prescribed intervention following a functional analysis assessment. Reinforcers identified as maintaining variables during assessment can be withheld following aberrant behavior and presented contingent on the omission of aberrant behavior or the emission of an appropriate alternative (Carr & Durand, 1985; Iwata, Dorsey, Slifer, Bauman, & Richman, 1982). Such an arrangement presumably teaches a client more appropriate means of obtaining reinforcers. However, at times differential reinforcement can produce extinction-induced side effects and can be difficult to administer; differential reinforcement of other behavior (DRO) requires continuous monitoring and recording of behavior to reset reinforcement intervals (Vollmer et al., 1993). NCR apparently circumvents some of the shortcomings of differential reinforcement.

Although differential reinforcement and noncontingent reinforcement are most typically characterized as positive reinforcement-based interventions (e.g., Iwata, Vollmer, & Zarcone, 1990; Lennox, Miltenberger, Spengler, & Erfanian, 1988), the procedures are equally relevant to negative reinforcement contingencies (Iwata, 1987). Aggression and self-injury are particularly susceptible to socially mediated escape and avoidance contingencies because the serious nature of the behavior often requires termination of ongoing activities, such as

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instructional sessions (Carr, 1977). Several studies have reported functional analyses that identified escape as a maintaining consequence for aberrant behavior (e.g., Carr, Newsom, & Binkoff, 1976; Iwata, Pace, Cowdery, Kalsher, & Cataldo, 1990; Weeks & Gaylord-Ross, 1981). Recent epidemiological data suggest that over 38% of functional analyses of self-injurious behavior (SIB) show differential responsiveness to socially mediated escape contingencies (Iwata et al., 1994).

Because a functional analysis almost directly prescribes differential reinforcement, previous studies examining treatments for negatively reinforced aberrant behavior have emphasized two components: withholding of escape contingent on aberrant behavior (e.g., Iwata, Pace, Cowdery, Kalsher, & Cataldo, 1990) and differential delivery of escape (e.g., Steege et al., 1990). However, using the principles of noncontingent reinforcement, it is possible that response suppression could be accomplished without withholding or differentially delivering escape. Response-independent access to escape on a fixed-time schedule would be analogous to previously studied noncontingent positive reinforcement schedules. Although not common, noncontingent escape (NCE) constitutes a variation of extinction: Hineline (1977) pointed out that definitions of extinction for negatively reinforced behavior may focus on "the contingency between response and reinforcement, rather than simply on the discontinuation of reinforcement" (p. 379). Indeed empirical research has demonstrated that withholding reinforcers is not a requirement to obtain extinction effects; rather, the elimination of the contingency between behavior and its maintaining consequences defines extinction (Boakes, 1973; Catania, 1992; Rescorla & Skucy, 1969). In addition, the necessity of providing escape *contingent* on response omission (differential negative reinforcement of other behavior, DNRO) or alternative response emission (differential negative reinforcement of alternative behavior, DNRA) is untested. Independent of its extinction effects, noncontingent delivery of escape may reduce the motivation to engage in escape-maintained behavior (Davenport & Olson, 1968; Hineline, 1977).

Additional support for NCE is found in treatment studies on negatively reinforced behavior. Iwata, Pace, Cowdery, Kalsher, and Cataldo (1990) extinguished negatively reinforced SIB by presenting inescapable instructional demands on a fixed-time (FT) 30-s schedule. Despite eventual reductions in SIB, the extinction procedure resulted in "extinction bursts" with several participants; extinction-induced phenomena and behavioral persistence have also been reported in recent replication studies (Goh & Iwata, 1994). NCE may serve as extinction because it eliminates the contingency between SIB and escape, but it may potentially reduce extinction bursts because of the noncontingent access to escape. Although variants of differential reinforcement procedures, such as functional communication training (Carr & Durand, 1985), may also reduce extinction-induced behavior, there can be occasions when reinforcement of alternative behavior is difficult. For example, if a child is receiving a bath, undergoing medical examination, or walking to the school bus, reinforcement of an alternative escape response may be impossible or otherwise not desirable. This is not to say that functional communication training is undesirable; rather, there may be times or activities more suitable to extinction.

In another recent application, Pace, Iwata, Cowdery, Andree, and McIntyre (1993) showed that the elimination of aversive stimulation (instructions) resulted in a suppression of SIB. The experimenters gradually increased the rate of instructions, while maintaining low rates of SIB. Thus, if an NCE schedule was arranged to introduce aversive stimulation gradually, alterations in establishing operations may augment extinction effects. Although escape behavior can be completely eliminated by removing the establishing operations (i.e., removing all aversive stimulation), such interventions are not normally recommended for individuals in learning environments. Specifically, in applied settings, the functionally aversive stimulation is often instructional activity, which cannot or should not be eliminated entirely because the opportunity for learning is hindered (Kennedy, 1994).

Noncontingent escape (NCE) may have further

practical utility. Recent positive reinforcement-based interventions have not only demonstrated that NCR is effective but that under certain circumstances the procedure may have advantages over differential reinforcement. More specifically, Vollmer et al. (1993) examined the effectiveness of NCR in comparison to DRO. In that study, 3 women participated in a functional analysis and analogue intervention analysis. During the functional analysis, the SIB of all 3 women showed differential responsiveness to positive reinforcement in the form of attention. During DRO, attention was delivered contingent on the absence of SIB for prespecified intervals. During NCR, attention was delivered on an FT schedule that was not influenced by the participant's behavior. Results showed that NCR was easier to implement than DRO, produced fewer side effects than DRO, and was at least equally effective in reducing SIB.

Vollmer et al. (1993) and Hagopian et al. (1994) point out an additional advantage of noncontingent reinforcement: ease of implementation. With noncontingent positive reinforcement, a parent or teacher need only know the target time for reinforcer delivery. For example, if attention delivery is scheduled once per 5 min, the subject's behavior does not influence that schedule and resetting an interval timer is not necessary. This "ease of implementation" issue may be equally relevant to escape-maintained behavior. It may be very difficult for a caregiver to provide escape on a differential time-based schedule while concentrating on instructional activities. Periodic, response-independent escape (fixed-time) intervals should be less difficult to administer with integrity. If the schedule of reinforcement (escape) is initially rich, it may be possible to fade the escape–escape interval to practically useful periods, such as a 10-min bath or examination or a 5-min walk to the bus.

Given the potential conceptual importance and practical utility of NCE, we examined the procedure's effects on the behavior of 2 participants with negatively reinforced SIB. This analysis may extend the current literature in the following ways: (a) The effects of noncontingent schedules of reinforcement have not been examined for behavior maintained by negative reinforcement, (b) the role of NCE as an extinction procedure has not been examined (although it was not our intention to compare NCE to other forms of escape extinction, an initial evaluation may help to ascertain whether further comparison studies are warranted); and (c) one DNRO intervention is presented to establish the comparable effectiveness of NCE.

## METHOD

### *Subjects and Setting*

Two young males, both of whom attended public schools, participated. Participants were selected based on referral for treatment of chronic SIB, and were screened for inclusion in this study based on the results of an assessment designed to identify the functional properties of their SIB (see Functional Analysis below). Thus, Kevin and Mark were the first 2 individuals deemed appropriate for this study. Both individuals participated with the informed consent of their parents.

Kevin was an 18-year-old male diagnosed as profoundly mentally retarded. He attended a public school for children and adolescents with developmental disabilities. He had a 16-year history of severe SIB, including head punching and face hitting. Kevin was not aggressive or destructive. He could walk independently, but was often resistant. He displayed no conventional verbal behavior (such as spoken words or manual gestures) and was dependent on full assistance in his self-care and daily living activities. Kevin frequently showed positive responses to social interaction (such as smiles and laughter) when demands were not placed on him.

Mark was a 4-year-old boy who displayed autistic-like behaviors, but he had not been formally diagnosed at the time of this study. He attended a preschool for children with various developmental and physical disabilities. He was referred for treatment because of a 2-year history of SIB, including hand biting and head banging. He was occasionally aggressive and disruptive, but the most serious concern to his teachers and family was SIB. Mark was well coordinated and self-ambulatory. He rarely talked, with the exception of an occasional imitative utterance, but was learning a few manual signs

(such as "eat"). He was not yet trained in self-care activities and was resistant to preacademic instructional sessions.

Kevin's sessions were conducted at his school in an adaptive physical education room that was approximately 5 m by 7 m. The room had a table, physical education equipment, and a one-way observation window; other contents of the room varied according to experimental conditions. Mark's sessions were conducted at his preschool in a classroom used for therapy sessions. The room was approximately 7 square meters and had a carpeted floor; one wall was lined with large windows. Contents of the room varied according to experimental condition. Sessions lasted 10 min and usually took place 4 days per week. Two to four sessions were conducted per day, depending on variations in the participants' daily schedules.

*Response Measurement*

Topographies of SIB included head hitting or punching (Kevin), head banging (Mark), and hand or arm biting (Mark). *Head hitting or punching* was defined as forceful contact against the head or face by the hand or fist. *Head banging* was defined as forceful contact by the head against any hard surface, including furniture, the wall, or the floor. *Hand or arm biting* was defined as forceful contact between the teeth and the hand or arm.

The primary dependent variable of interest was responses per minute of SIB. Data were collected using hand-held computers. Observers were trained graduate and undergraduate students. Graduate students had been trained previously in behavioral observation. Undergraduate students were trained before the study began and were required to score at least 90% agreement (with a previously trained primary observer) on all dependent variables for two consecutive sessions for 2 different participants. Interobserver agreement was assessed by having a second observer simultaneously but independently record data with a primary observer. Percentage agreement scores were computed by dividing the session length into consecutive 10-s intervals. The smaller number of observed responses was divided by the larger number of observed responses in each interval, and these values were averaged across the session. Agreement was assessed during 28.6% of the functional analysis sessions, 23.1% of the baseline sessions, and 32.5% of treatment sessions. Average agreement scores on SIB exceeded 94% during all conditions.

*Functional Analysis (Assessment)*

The assessment was based on the procedures described by Iwata et al. (1982). A series of conditions was presented in multielement format to each subject. Briefly, these included positive reinforcement (attention or tangible), in which the experimenter did not attend to the participant except to deliver reprimands, statements of concern, and/or preferred tangible stimuli contingent on SIB. For Mark, there were two different positive reinforcement conditions: In one he received contingent attention, and in the other he received contingent access to preferred toys. The purpose of the positive reinforcement condition(s) was to determine whether the participant's behavior was responsive to attention or materials as positive reinforcement. In the escape condition, the experimenter presented instructional trials to the participant on an FT 30-s schedule, and a time-out from instructional trials was made contingent on SIB. For Kevin, instructions consisted of requests to walk from place to place, body-part identification, or puzzle work. For Mark, instructions consisted of table-top preacademic activities. After Mark's fourth escape session, he was required to stay seated during the instructional period. Escape from the instructional context (seatwork) was made contingent on SIB. The purpose of this condition was to determine whether the participant's behavior was responsive to escape from instructional sessions as negative reinforcement. In the no-interaction condition, participants were observed in a room without access to play materials, and no social consequences were placed on SIB. The purpose of this condition was to identify whether the participant's SIB was maintained independent of social consequences. In the play condition, the experimenter provided opportunities for interaction on an FT 30-s schedule and continuous access to preferred items (as identified in a

stimulus preference assessment). The purpose of this condition was to observe the rate of SIB in an enriched environment that contained no instructional demands; this condition served as a control.

*Treatment Analysis*

All sessions began with a three-prompt request to "go for a walk" (Kevin) or "come to the table" (Mark). The three-prompt sequence consisted of a verbal request, model, and finally physical guidance. This sequence was repeated following breaks from participation. Treatment effects were examined by using a combined multiple baseline across subjects and reversal design. The effects of NCE were examined using the multiple baseline across subjects, and the relative effects of DNRO and NCE (for Mark) were examined within a reversal (A-B-A-C) design.

*Baseline.* Baseline conditions were virtually identical to the escape conditions in the functional analysis. However, for Kevin we selected walking as the instructional context, because escape behavior during walking was pronounced and was causing the most problems at school. Thus, Kevin's baseline sessions consisted of a 10-min walk around the adaptive physical education room. Chairs were strategically placed around the room, and he was given a 30-s break from walking contingent on SIB. For Mark, the instructional context was sitting at the table while receiving prompts to participate on an FT 30-s schedule. The results of his functional analysis had shown that staying seated was correlated with SIB. He was given a 20-s break from table-work contingent on SIB (i.e., he could leave the table). For both participants, breaks were signaled verbally and physically: They were told "okay, take a break now." For Kevin, the therapist walked away from him while verbally signaling the break. For Mark, the therapist pulled Mark's chair away from the table while verbally signaling the break.

*Noncontingent escape (NCE).* The experimenter allowed the participant to "take a break" (i.e., escape) on an FT schedule, in which the participant's behavior did not influence the frequency of escape. SIB no longer directly produced escape, but breaks were not delayed or withheld when SIB occurred. For example, if the current FT interval was 2 min, the participant received one break after 2 min, independent of whether SIB had occurred during the interval. Physical guidance was used as necessary to keep the participant on task (Iwata et al., 1990). The FT escape schedule was established prior to beginning each session.

For Kevin, breaks lasted 30 s (matching baseline). As in baseline, the instructional context was walking; breaks were signaled verbally and physically. The schedule for increasing the FT intervals (interreinforcement intervals) combined the fading schedules described by Vollmer et al. (1993) and Hagopian et al. (1994). The escape schedule was faded from continuous escape to FT 10 min. The fading was accomplished across sessions by adding 10 s to the interval (initially) when the SIB rate was at or below 0.3 responses per minute during any given session. After the FT schedule reached 1 min, the schedule increased in larger units from 1 min, to 1.5 min, to 2.0 min, to 2.5 min, to 3.0 min, to 4.0 min, to 5.0 min, and finally to 10 min (see Vollmer et al., 1993, for an analogous fading schedule). If the SIB rate did not go below 0.3 responses per minute for two consecutive sessions and was on an upward trend, the fading schedule was set back to the previously accomplished step (Hagopian et al., 1994).

For Mark, breaks lasted 20 s (matching baseline). As in baseline, the instructional context was table-work; breaks were signaled verbally and physically. The schedule of escalating FT intervals differed from that of Kevin and from that of prior studies using noncontingent schedules. Specifically, the increase was based on a formula for DRO intervals discussed by Poling and Ryan (1982); prior to each session the FT interval length was determined by computing the mean interresponse time (IRT) from the preceding five sessions, although the interval was never decreased even if mean IRTs became shorter. For example, if the mean IRT was 30 s, the FT interval was set at 30 s. FT intervals were rounded to the nearest 5-s whole number that did not exceed the mean IRT (e.g., mean IRT = 44 s, FT interval = 40 s). This schedule allowed for a more direct comparison of

DNRO and NCE (see procedures for DNRO below). The eventual goal was to establish a 2.5-min FT interval.

The terminal FT interval was shorter for Mark than for Kevin for two reasons. First, the interval was being compared to DNRO, and it is possible that lengthy differential reinforcement intervals will eliminate contact with the reinforcer (see Vollmer et al., 1993, for a recent example). Very low rates of SIB may continually reset the differential reinforcement interval. Thus, Mark's terminal FT interval was established to match his terminal DNRO interval (described below). Second, table-work sessions in Mark's class rarely exceeded 5 min, so a 2.5-min interval was seen as developmentally and functionally appropriate. Following the logic of our procedure, in a 5-min session Mark would receive one 20-s break per class activity.

*Differential negative reinforcement of other behavior (DNRO).* Only Mark participated in DNRO. The experimenter allowed escape according to a resetting DNRO schedule. If Mark did not engage in SIB during a prespecified interval, a 20-s break was allowed at the end of the interval. Again, breaks were signaled verbally and physically. If Mark engaged in SIB at any time during a DNRO interval, the timer was reset (Repp & Deitz, 1974). For example, if the current DNRO interval was 1 min, Mark was required to tolerate the instructional context without SIB for 1 min in order to receive a 20-s break. The DNRO interval length was established using the same formula described above for Mark's NCE condition. The eventual goal was to establish a 2.5-min DNRO interval.

During all conditions, for both participants, rate of SIB was calculated for the entire 10-min session, including "break" intervals. This method is consistent with the data calculation in the three most recently published instructional fading studies (Pace et al., 1993; Zarcone et al., 1993; Zarcone, Iwata, Smith, Mazaleski, & Lerman, 1994). Although instructional fading schedules initially present lower levels of aversive stimulation than baseline, the cumulative break periods during instructional fading eventually become shorter than the cumulative break periods during baseline (especially if instructions produce SIB immediately during baseline, because SIB in turn produces frequent breaks). Thus, terminal treatment effects cannot be attributed to an overall decrement in aversive stimulation.

## RESULTS

### *Functional Analysis*

Figure 1 displays results of the functional analyses. The results show that, for both subjects, SIB was differentially responsive to escape as negative reinforcement. Kevin's rate of SIB was consistently highest in the escape sessions (range, 0.5 to 7.9) when compared to other sessions in other conditions (range, 0 to 1.0). Similarly, Mark's rate of SIB was highest during escape sessions (range, 0 to 4.0) when compared to other sessions in other conditions (range, 0 to 0.4). The rate of escape behavior increased substantially when he was required to remain seated during instructional activities. The instructional context was changed to table-work because Mark's teacher and parents had reported high rates in that context; we had seen little SIB otherwise.

### *Treatment Conditions*

Figure 2 shows the results of treatment for both participants. For Kevin, the implementation of NCE resulted in virtually immediate suppression of SIB in comparison to baseline. The median SIB rate for Kevin during baseline was 1.6 (range, 0.3 to 4.0) compared to a treatment median of 0 (range, 0 to 8.3). There was one session during which the rate of self-injury was extremely high (8.3 per minute); this session corresponded with a shift from FT 2.5 min to FT 3.0 min. Although it is not possible to say with certainty, it appeared that it was at this point that Kevin's behavior contacted the absence of an escape contingency—the instructional context persisted despite SIB. Previously, the rich schedule of breaks may have reduced the motivation to escape. Indeed, following the high-rate session, an apparent extinction curve was obtained.

For Mark, both DNRO and NCE were effective in suppressing SIB, although NCE had a more

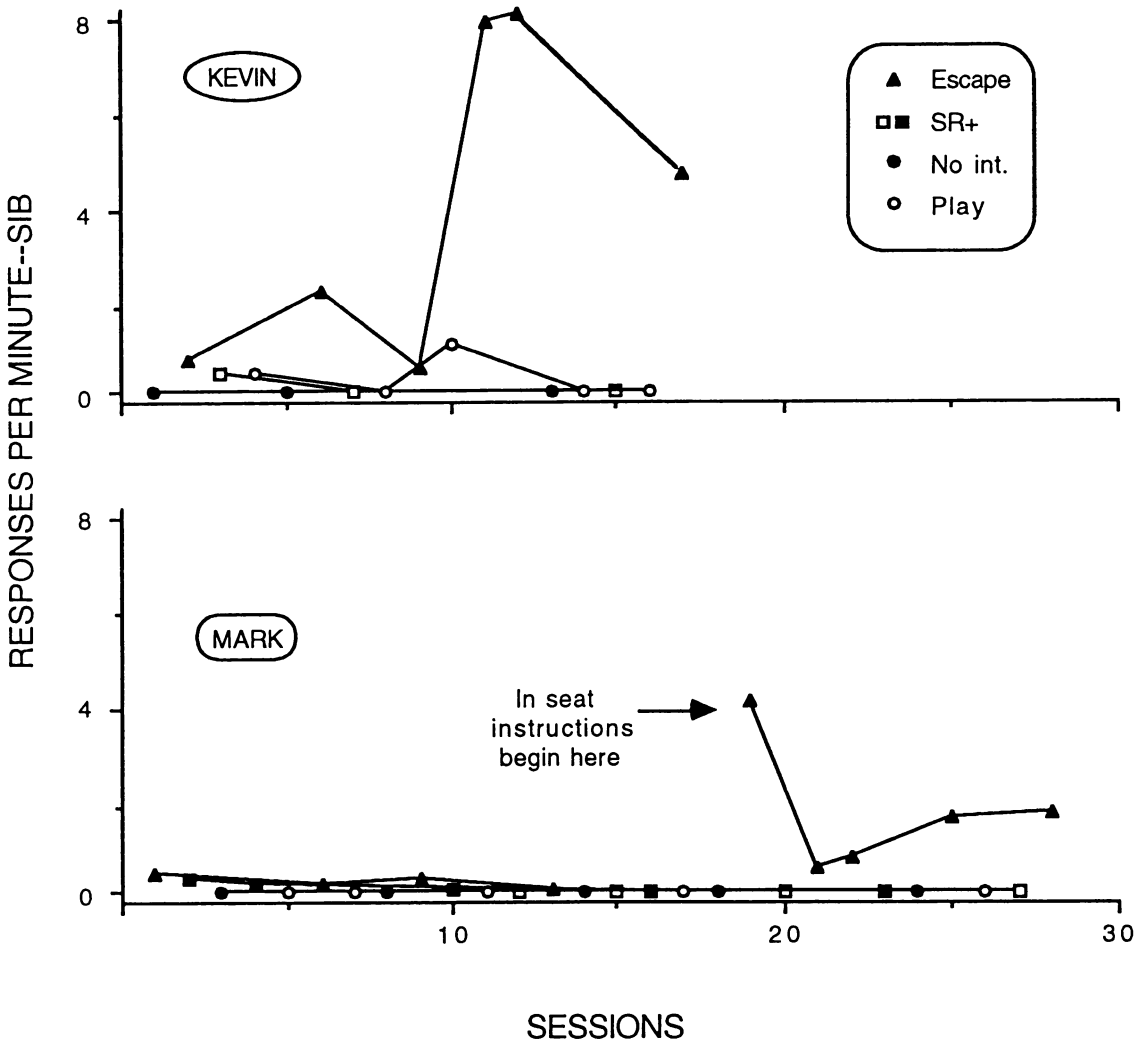


Figure 1. Responses per minute of SIB across assessment conditions.

immediate suppressive effect. During baseline conditions, the median SIB rate was 3.2 (range, 0.4 to 12.8). During DNRO, the median SIB rate was 0.9 (range, 0 to 5.8). During NCE, the median SIB rate was 0 (range, 0 to 2.4). Further, the use of IRT-adjusting schedules of reinforcement did not appear to adversely influence the application of NCE in comparison to Kevin's treatment.

## DISCUSSION

This study can be viewed as a systematic replication of previous studies on noncontingent reinforcement, extending that work to the treatment of negatively reinforced behavior. The results of this study show that NCE can be an effective treatment procedure for SIB that is maintained by escape. These results are particularly interesting in light of the fact that previous treatments have emphasized the contingent relation between alternative behavior and escape. The contingent nature of reinforcer delivery in differential reinforcement procedures may be of significance as a reductive component only when arbitrary reinforcers are used (Vollmer et al., 1993). When noncontingent reinforcement is based on the results of a functional

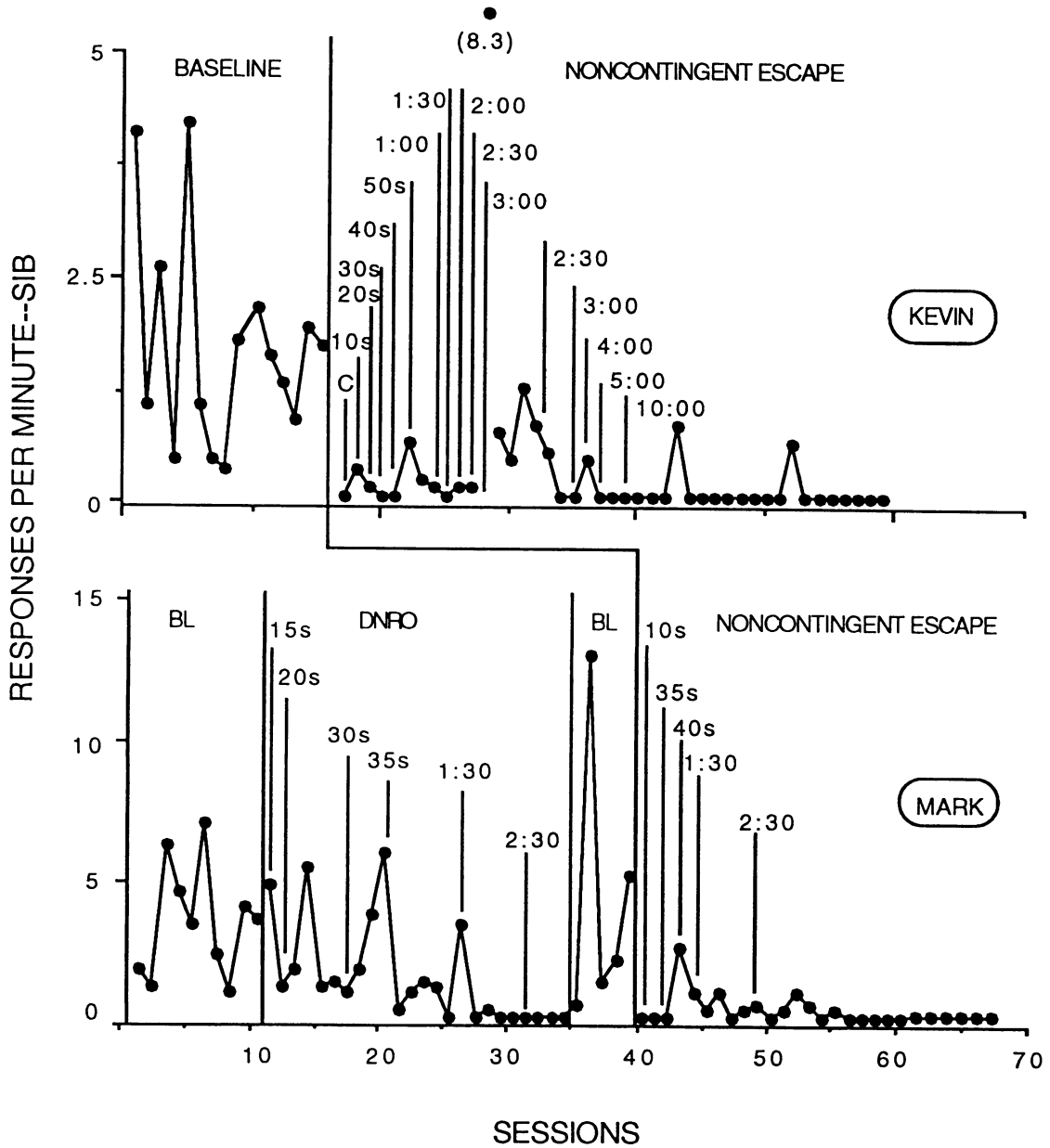


Figure 2. Responses per minute of SIB during baseline, DNRO (Mark, lower panel), and NCE (both participants). Lines marked with time intervals point to sessions in which NCE or DNRO intervals were changed.

analysis, the contingency between aberrant behavior and reinforcement can be eliminated. Further, the periods of escape can be provided on a decreasingly rich schedule, which may reduce the motivation (at least initially) to engage in escape behavior.

Despite the positive results of this study and previous work on NCR, we are not suggesting that NCE and NCR are the only alternatives, or even the best alternatives, to other extinction-based procedures. Durand and Carr (1991) have argued convincingly that access to an alternative escape or attention-seeking response (functional communication training) reduces the likelihood of extinction-induced behavior. Nonetheless, there may be cir-

cumstances when alternative responses either cannot or should not be reinforced. In such cases, an extinction-based procedure may be warranted. This study showed that extinction was accomplished using fixed-time escape schedules in which the escape–escape interval was progressively increased to useful (or socially valid) intervals. Importantly, the application of NCR or NCE does not necessarily preclude the superimposition of differential reinforcement contingencies for the purposes of functional communication training or development of adaptive alternative behavior at appropriate times of the day.

As has been discussed previously, in this paper and elsewhere (e.g., Hagopian et al., 1994; Vollmer et al., 1993), noncontingent reinforcement schedules can be easier to implement than DRO schedules. Given that the results of DNRO and NCE were comparable for Mark, NCE may be a preferable treatment in some instances. Further study is required to compare differential negative reinforcement to NCE along relevant dimensions such as extinction-induced behavior and rapidity of effect. The inclusion of a DNRO condition in this study was not intended to be a definitive comparison between the two procedures; rather, Mark's data showed that NCE was at least comparable in effectiveness in his particular case. Comparisons between the two procedures, as presented here, should be viewed with caution because sequence effects were not controlled for. The more rapid suppression of SIB seen in NCE may have been a function of Mark's recent history with DNRO. On the other hand, Kevin's data show that a history with DNRO cannot be the sole factor in NCE's effects.

Despite the procedure's relative simplicity, methods for increasing FT escape schedules may be somewhat cumbersome. Whether fading is accomplished using preset criteria (as with Kevin) or using an IRT-adjusting schedule (as with Mark), relatively sophisticated calculations and analyses of trends may be required. As such, parents and teachers may request more extensive consultation from professionals at the outset of NCE- or NCR-based interventions. Nonetheless, once the terminal schedule is reached, given that it is time-based and not influenced by the client's behavior, the procedure has potential for high implementation integrity. Further, the necessity of the fading component remains unknown: The principal component of intervention may have been extinction alone, which would make implementation even easier. To the extent that ease of implementation supports treatment integrity, future research should examine the relative fidelity across various interventions for escape-maintained behavior.

Although it would be easier to conduct noncontingent schedules without a fading component, it is likely that initially rich schedules of escape reduce the motivation to engage in escape behavior. Thus, early suppression may have been related to motivation rather than extinction per se (Hineline, 1977; Shnidman, 1968). Literally, in the early sessions, there was no aversive stimulation from which to escape. In a sense, the issue of motivational versus extinction effects is analogous to the questions raised by recent research on instructional (demand) fading (e.g., Pace et al., 1993; Zarcone et al., 1994). As those studies showed, early sessions may rely on establishing operations and later sessions may rely on extinction to suppress aberrant behavior. As Kevin's data indicate, there was probably a combination of both variables at work, because his behavior appeared to contact extinction when the walking requirement was increased to a 3-min interval. That is, SIB no longer produced escape after a recent history of continuous escape following SIB.

Future research may assess the role of each NCE component. We have presented an NCE package that involves extinction (elimination of the reinforcement contingency), manipulations of establishing operations (time-based provision of escape), and instructional fading. The relative influence of each feature may be examined through component analyses or by systematic manipulation of contingencies. For example, the role of extinction versus the role of establishing operations could be examined by superimposing a DNRA contingency (such as reinforcement of a communicative response or compliance to discrete instructional trials) upon an NCE schedule. If the participant is still motivated to escape, the alternative response should

occur frequently despite the "free" access to escape on a fixed-time schedule. Our preliminary data with *positively* reinforced SIB have shown that participants exposed to NCR will still request reinforcers when given the opportunity to do so (Marcus & Vollmer, 1994). Conversely, changes in motivational variables may be assessed by keeping the NCE schedule intact, while continuing to negatively reinforce SIB. If motivational variables are operative, the client should be less inclined to engage in escape behavior.

Further comparisons are needed to evaluate the relative effectiveness of NCE and other treatments for negatively reinforced behavior. Although 1 participant in our study responded positively to DNRO and NCE, this study did not thoroughly compare a set of procedures along critical dimensions. Relative effectiveness of various extinction and differential negative reinforcement procedures could be explored along the dimensions of immediacy of effect, durability of effect, resistance to integrity failures, and so on. Similarly, the relative acceptability of noncontingent schedules as treatment could be compared to other interventions; it has been widely suggested that treatment acceptability leads to a greater likelihood of treatment implementation (Witt, 1986). Behavior analysts now have a sort of "menu" of treatment options based on the results of functional analyses, so we may begin to explore the conditions under which a given procedure should be or would be selected over other interventions.

At least two potential limitations of this study require mention. First, our entire analysis was conducted in analogue settings. Further research will be necessary to ascertain the true practical value of NCE. Although we did conduct family training and teacher training following this study, we consider transfer of the procedure's effects to be a separate experimental issue. Although not conducted experimentally, our pre- and posttraining data suggest that the procedures have been incorporated with integrity and with beneficial effects for both participants.

A second potential problem is related to the NCE procedure per se. Specifically, accidental reinforcement may occur if escape is provided (by happenstance) contiguous to episodes of SIB. Fixed-time schedules of reinforcement have been shown to maintain behavior for relatively extended periods of time before resulting in extinction (Skinner, 1948), presumably due to accidental reinforcement effects. So far, no treatment studies on NCR or NCE have reported behavioral maintenance with fixed-time schedules, but the possibility should be noted. At times, our participants did engage in SIB immediately (within 10 s) prior to the programmed escape interval. The fact that responding did not persist supports the notion that reinforcement is ultimately an issue of contingency rather than contiguity (Catania, 1992). That is, the response-independent presentation of escape coupled with the instances of SIB that did not produce escape probably outweighed the occasional response-contiguous presentation of escape. To be safe, however, one derivation of NCE that might avert the potential problem of accidental reinforcement would be a momentary differential reinforcement schedule (Repp, Barton, & Brulle, 1983), in which escape would be provided contingent on the momentary absence of SIB at fixed-time sampling intervals.

To conclude, the emerging literature on noncontingent schedules of reinforcement emphasizes a rather uncommon view of extinction. This study may serve as an impetus to further analyze noncontingent reinforcement as treatment for behavior maintained by escape. Although preliminary applied studies on NCE and NCR have been conducted exclusively with severe behavior disorders in developmental disabilities, similar applications seem to be appropriate for other problem areas. For example, parents may find bedtime extinction of crying or tantrums more acceptable if coupled with frequent noncontingent bed-checks (Blampied & France, 1993). In classrooms, teachers may be more disposed to implement fixed-time reinforcement schedules of escape or attention as treatment for socially maintained disruptive behavior.

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